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ENHANCED WOOD PALLET WITH AND WITHOUT METAL STRIP UNDER THE PALLET SKID MIL-STD-1660 TESTS

Prepared for:
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and Engineering Center
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The U.S. Army Defense Ammunition Center (DAC), Validation Engineering Division (SIOAC-DEV), was tasked by the U.S. Army Armament Research, Development and Engineering Center (ARDEC) to conduct MIL-STD-1660 tests on a 40-3/4- by 44-1/2-inch enhanced wood pallet with and without a metal strip. This report contains test results with the pallets provided meeting MIL-STD-1660, Design Criteria for Ammunition Unit Loads, requirements.

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U.S. ARMY DEFENSE AMMUNITION CENTER
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ENHANCED WOOD PALLET WITH AND WITHOUT METAL STRIP UNDER THE PALLET SKID MIL-STD-1660 TESTS

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PART 1

INTRODUCTION

A. BACKGROUND. The U.S. Army Defense Ammunition Center (DAC), Validation Engineering Division (SIOAC-DEV), was tasked by the U.S. Army Armament Research, Development and Engineering Center (ARDEC) to conduct MIL-STD-1660 tests on a 40-3/4- by 44-1/2-inch enchanced wood pallet with and without a metal strip.

B. AUTHORITY. This test was conducted IAW mission responsibilities delegated by the U.S. Army Armament, Munitions and Chemical Command (AMCCOM), Rock Island, Illinois.

C. OBJECTIVE. The objective of these tests was to determine whether the enhanced wood pallet would be capable of meeting MIL-STD-1660, Design Criteria for Ammunition Unit Loads, requirements.

D. CONCLUSION. The enhanced wood pallet with and without a metal strip under the pallet skid met MIL-STD-1660 requirements.

PART 2

15 - 17 JANUARY 1997

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PART 3

TEST PROCEDURES

The test procedures outlined in this section were extracted from MIL-STD-1660, Design Criteria for Ammunition Unit Loads, 8 April 1977. This standard identifies nine steps that a unitized load must undergo if it is to be considered acceptable. The four tests that were conducted on the test pallets are summarized below.

A. STACKING TEST. The unit load was loaded to simulate a stack of identical unit loads stacked 16 feet high, for a period of one hour. This stacking load was simulated by subjecting the unit load to a compression weight equal to an equivalent 16-foot stacking height. The compression load was calculated in the following manner. The unit load weight was divided by the unit load height in inches and multiplied by 192. The resulting number was the equivalent compressive force of a 16-foot-high load.

B. REPETITIVE SHOCK TEST. The repetitive shock test was conducted IAW Method 5019, Federal Standard 101. The test procedure is as follows: The test specimen was placed on, but not fastened to, the platform. With the specimen in one position, the platform was vibrated at 1/2-inch amplitude (1-inch double amplitude) starting at a frequency of approximately 3 cycles per second. The frequency was steadily increased until the package left the platform. The resonant frequency was achieved when a 1/16-inch-thick feeler gage momentarily slid freely between every point on the specimen in contact with the platform at some instance during the cycle or a platform acceleration achieved 1 +/- 0.1 Gs. Midway into the testing period, the specimen was rotated 90 degrees and the test continued for the duration. Unless failure occured, the total time of vibration was two hours if the specimen was tested in one position and three hours for more than one position.

C. EDGEWISE ROTATIONAL DROP TEST. This test was conducted using the procedures of Method 5008, Federal Standard 101. The procedure for the edgewise rotational drop test is as follows: The specimen was placed on its skids with one end of the pallet supported on a beam 4-1/2 inches high. The height of the beam was increased if necessary to ensure that there was no support for the skids between the ends of the pallet when dropping took place, but was not high enough to cause the pallet to slide on the supports when the dropped end was raised for the drops. The unsupported end of the pallet was then raised and allowed to fall freely to the concrete, pavement, or similar underlying surface from a prescribed height. Unless otherwise specified, the height of drop for level A protection conforms to the following tabulation:

GROSS WEIGHT (WITHIN RANGE LIMITS) (Pounds)	DIMENSIONS OF ANY EDGE, HEIGHT OR WIDTH (WITHIN RANGE LIMITS) (Inches)	HEIGHT OF DROPS ON EDGES	
		Level A (Inches)	Level B (Inches)
150 - 250	60 - 66	36	27
250 - 400	66 - 72	32	24
400 - 600	72 - 80	28	21
600 - 1000	80 - 95	24	18
1000 - 1500	95 - 114	20	16
1500 - 2000	114 - 144	17	14
2000 - 3000	Above 145 - No limit	15	12
Above - 3000		12	9

D. INCLINE-IMPACT TEST. This test was conducted by using the procedure of Method 5023, Incline-Impact Test of Federal Standard 101. The procedure for the incline-impact test is as follows: The specimen was placed on the carriage with the surface or edge which is to be

impacted projecting at least 2 inches beyond the front end of the carriage. The carriage was brought to a predetermined position on the incline and released. If it is desired to concentrate the impact on any particular position on the container, a 4- by 4-inch timber was attached to the bumper in the desired position before the test. No part of the timber was struck by the carriage. The position of the container on the carriage and the sequence in which surfaces and edges are subjected to impacts was at the option of the testing activity and depends upon the objective of the tests. This test is to determine satisfactory requirements for a container or pack, and, unless otherwise specified, the specimen was subjected to one impact on each surface that has each dimension less than 9.5 feet. Unless otherwise specified, the velocity at time of impact was 7 feet per second.

PART 4

TEST EQUIPMENT

A. Enhanced Wood Pallet With Metal Strip.

1. Size:	40-3/4- by 44-1/2-inches
2. Pallet Load:	81mm containers
3. Quantity of Containers:	21
4. Weight Loaded:	4,017 pounds
5. Unit Load Height:	37.0 inches

B. Enhanced Wood Pallet Without Metal Strip.

1. Size:	40-3/4- by 44-1/2-inches
2. Pallet Load:	81mm containers
3. Quantity of Containers:	21
4. Weight Loaded:	4,017 pounds
5. Unit Load Height:	37.0 inches

C. Compression Tester.

1. Manufacturer:	Ormond Manufacturing
2. Platform:	60- by 60-inches
3. Compression Limit:	50,000 pounds
4. Tension Limit:	50,000 pounds

D. Transportation Simulator.

1. Manufacturer:	Gaynes Laboratory
2. Capacity:	6,000 pounds
3. Displacement:	1/2-inch amplitude
4. Speed:	50 to 400 rpm
5. Platform:	5- by 8-foot

E. Inclined Plane.

1. Manufacturer:	Conbur Incline
2. Type:	Impact Tester
3. Grade:	10 percent incline
4. Length:	12-foot

PART 5

TEST RESULTS

TEST OBSERVATIONS. Each test pallet was loaded with 21 81mm containers filled with approximately 190 pounds of iron granules, creating a 4,000-pound unitized load.

A. ENHANCED WOOD PALLET WITH METAL STRIP.

(1) STACKING TEST. The test sample was initially loaded to 21,000 pounds compression. After one hour, the compression was released. No physical damage to the test sample was noticed.

(2) REPETITIVE SHOCK TEST. The duration of the test was 90 minutes for each orientation of the test sample. In order to achieve the clearance between the test sample and the transportation simulator bed, the equipment was operated at 258 rpm for the lateral orientation and 276 rpm for the longitudinal orientation. No physical damage was noticed at the end of this test.

(3) EDGEWISE ROTATIONAL DROP TEST. Each side of the pallet base was placed on a beam displacing it 4-1/2 inches above the floor. The end of the test sample was raised to a height of 12 inches. The process was repeated in a clockwise direction until all four sides of the pallet had been tested. There was no physical damage noticed at the end of this test.

(4) INCLINE-IMPACT TEST. The incline-plane was set to allow the pallet to travel 8 feet prior to impacting a stationary wall. The pallet was rotated clockwise after each impact, until all four sides had been tested. No physical damage was noticed at the end of this test.

(5) END OF TEST INSPECTION. During final inspection, there was no physical damage noticed on the test sample.

B. ENHANCED WOOD PALLET WITHOUT METAL STRIP.

(1) STACKING TEST. The test sample was initially loaded to 23,000 pounds compression. No physical damage was noticed at the end of this test.

(2) REPETITIVE SHOCK TEST. The duration of the test was 90 minutes for each orientation of the test sample. In order to achieve the clearance between the test sample and the transportation simulator bed, the equipment was operated at 248 rpm for the lateral orientation and 264 rpm for the longitudinal orientation. No physical damage was noticed at the end of this test.

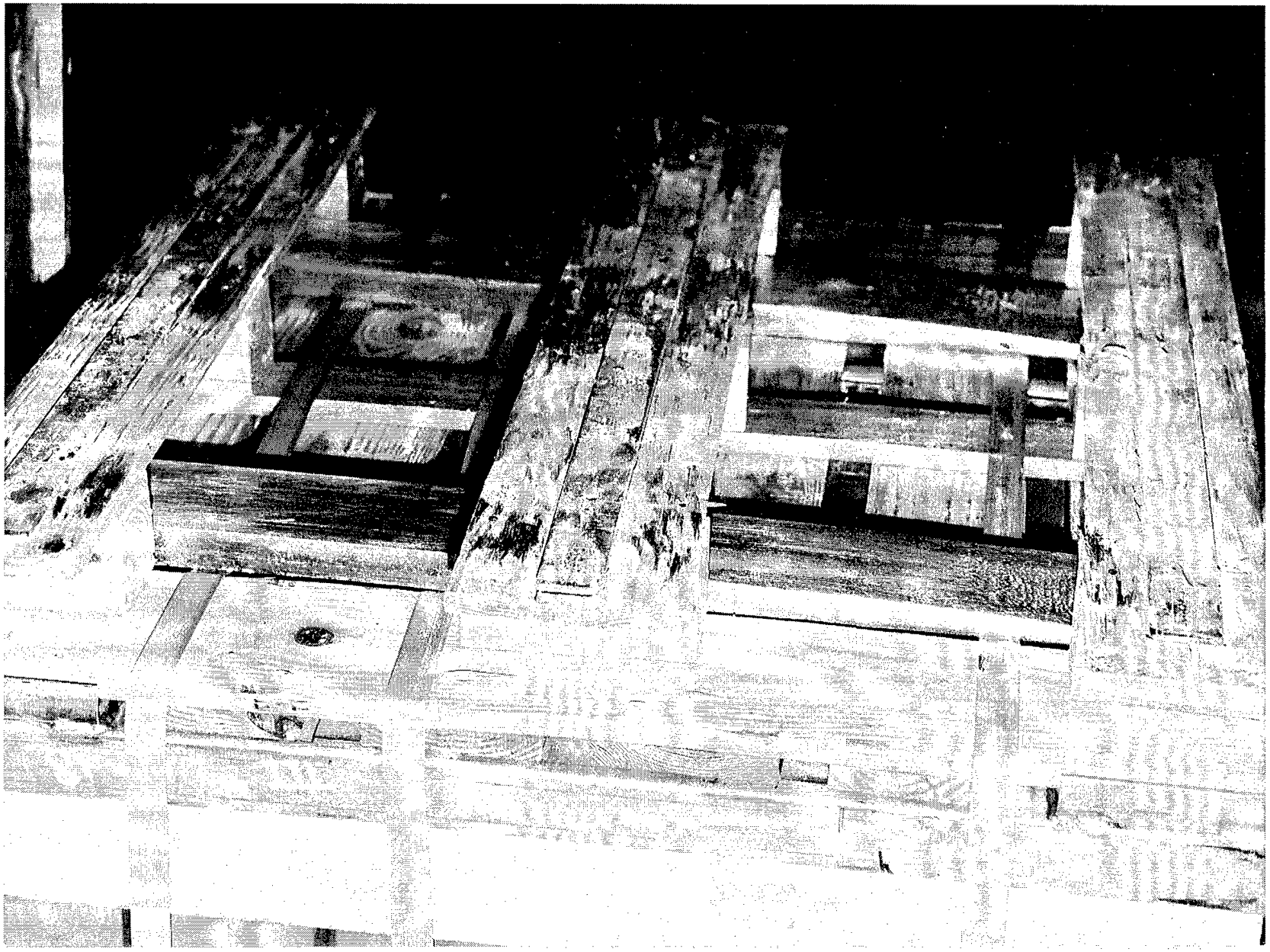
(3) EDGEWISE ROTATIONAL DROP TEST. Each side of the pallet base was placed on a beam displacing it 4-1/2 inches above the floor. The end of the test sample was raised to a height of 12 inches. The process was repeated in a clockwise direction until all four sides of the pallet had been tested. There was no physical damage noticed at the end of this test.

(4) INCLINE-IMPACT TEST. The incline-plane was set to allow the pallet to travel 8 feet prior to impacting a stationary wall. The pallet was rotated clockwise after each impact, until all four sides had been tested. No physical damage was noticed at the end of this test.

(5) END OF TEST INSPECTION. During final inspection, there was no physical damage noticed on the test sample.

PART 6

PHOTOGRAPHS



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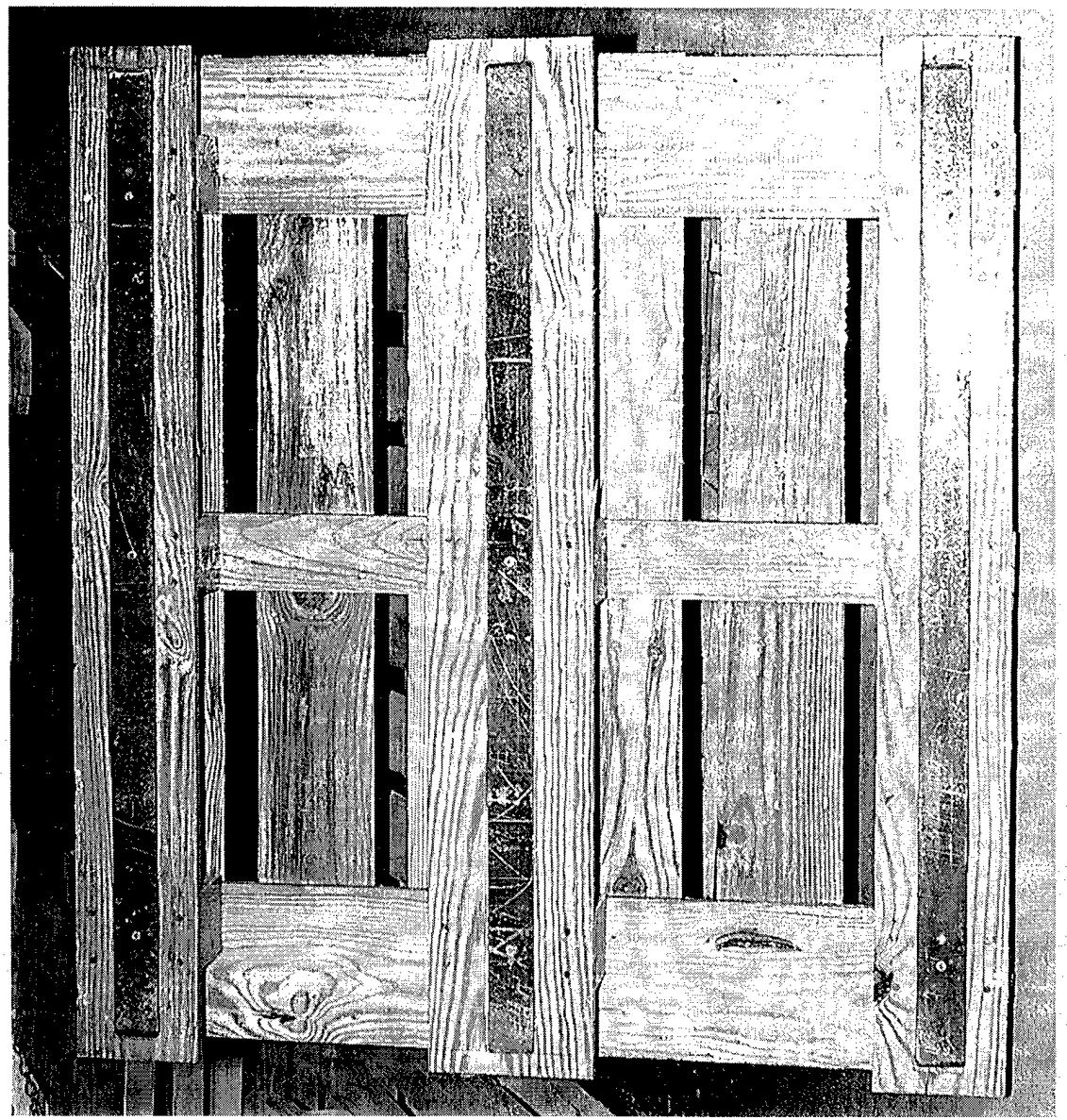
AO317-SCN-97-1523. This photo shows the enhanced wood pallet without metal strips.		



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